



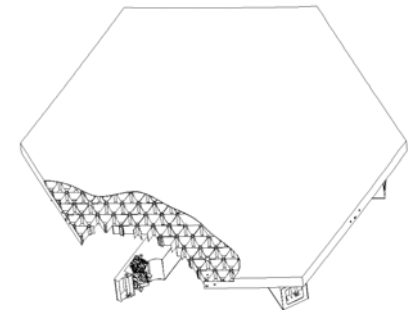
Ball Aerospace
& Technologies Corp.



Advanced Mirror System Demonstrator (AMSD) Phase II

Beryllium Semi-rigid Mirror Program Status

Ball Aerospace & Technologies, Inc.
22 May 2002

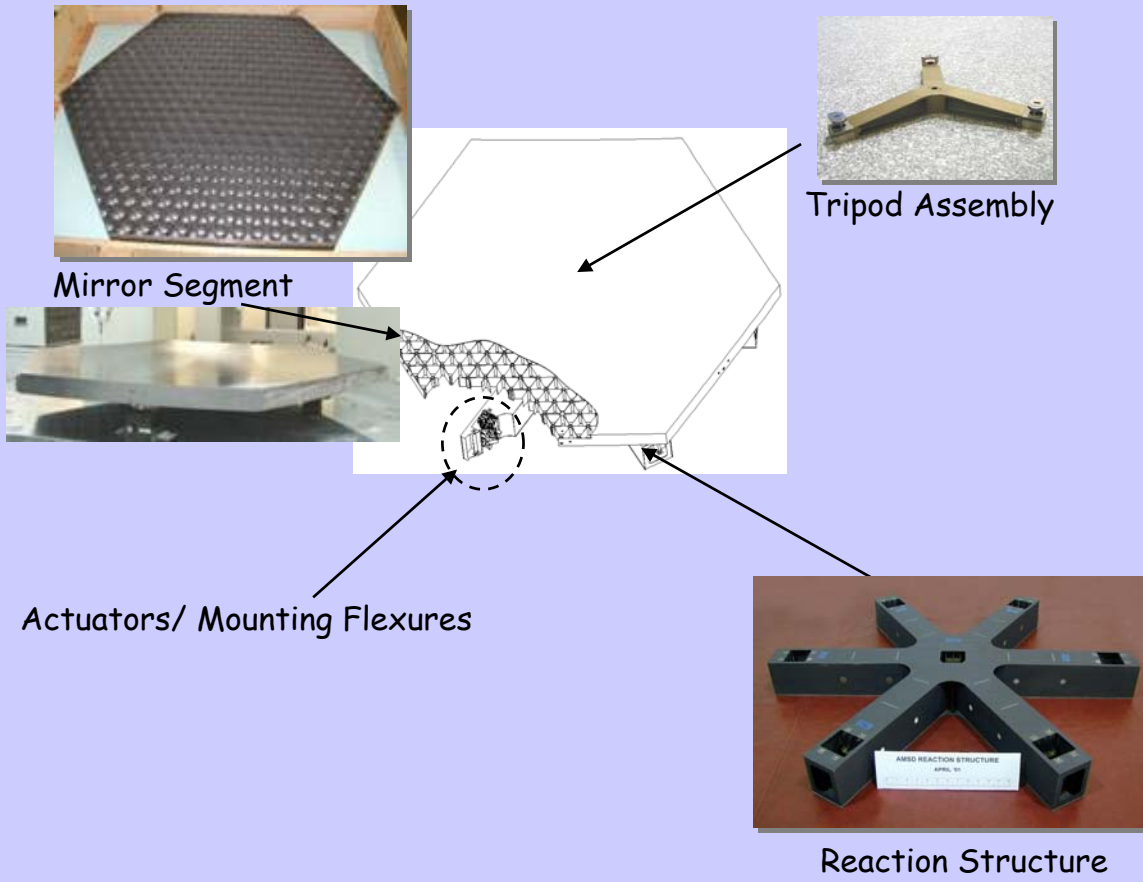




Overview of Ball's AMSD Design



Ball's Beryllium Semi-Rigid Design for AMSD



- 1.39-m point-to-point light-weighted beryllium semi-rigid mirror
- $< 15 \text{ kg/m}^2$ areal density for mirror system including mirror, reaction structure, flexures, and actuators
- Optical and physical characteristics traceable to NGST, SBL, and visible imaging
- Benefits from "lessons-learned" on Sub-scale Beryllium Mirror (SBMD) which achieved 19 nm rms surface at 38K



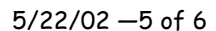
Summary of Progress made This Year



- Mirror –
 - Mirror delivered to Tinsley
 - Initial grinding process underway and is on schedule
 - Surface profiling to off-axis aspheric
 - Arrived with 151 μm P-V, 27- μm rms surface profile
 - By 18 April 2002: 35 μm P-V, 3.8 μm rms surface profile
- Actuators
 - Cryogenic testing is underway with the abbreviated ambient tests completed
 - Measurement system clearly identifies sub 10-nm step size
- Risk reduction tasks - designing and fabricating hardware to assist/ensure optical test success
 - Gravity off-load system
 - Mirror caging system
 - More mechanically clean attachment between actuators and reaction structure

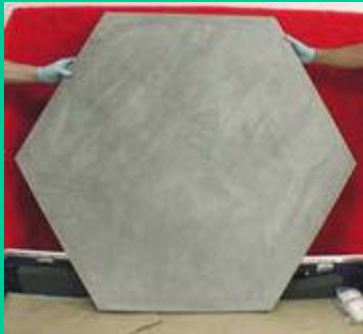


- Schedule
 - Tinsley activities proceeding as projected
 - Actuators should be fully qualified by end of May
 - Risk reduction hardware still in design/fabrication phase
 - Working with subcontractors to adjust delivery dates (fabrication house) and need dates (user)
 - Solution exists, need to keep on top of the schedules





Ball Semi-rigid Beryllium AMSD Program Status Summary



Mirror Lightweighting & Surface Profiling



Tripod Assembly

*Actuators in
Cryo-testing*



Reaction Structure

- Mirror lightweighting completed - surface grinding and profiling in-process
- AMSD actuators, tripod assembly, and reaction structure complete
- The beryllium, semi-rigid approach offers a viable, mature technology for large, lightweight, deployable mirrors
- Valuable "lessons learned" continue to benefit NGST production improving both technical performance & providing process and cost improvements
- The optical fabrication and testing of AMSD will provide timely information to NGST primes for selecting a producible primary mirror array